

Product Line CST

User Manual

(Preliminary)

EMS
THOMAS WÜNSCHE

Sonnenhang 3
D-85304 Ilmmünster
Tel +49-8441-490260
Fax +49-8441-81860

User Manual for Product Line CST

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For technical assistance please contact

EMS Dr. Thomas Wünsche
Sonnenhang 3

D-85304 Ilmmuenster

Tel.: +49-8441-490260

Fax: +49-8441-81860

Mail: support@ems-wuensche.com

Our products are continuously improved. Due to this fact specifications may be changed at any time and without announcement.

WARNING: CST devices and accompanying software may not be used in applications where damage to life, health or private property may result from failures in or caused by these components.

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1 Overview

1.1 Features

- Multifaceted solution for I/O functions on the CAN bus
- CiA and ISO 11898 compatible bus interface
- Automatic data rate detection based on a table with standard values
- Independent intelligence due to microcontroller 80C32 or DS 80C320
- Robust layout (electronics completely enclosed in epoxy resin)
- Compact structure for use in cramped conditions
- Modules available for different application types
- Modular setup for easy adaptation to application demands

1.2 General Description

The CAN modules of the CST Product Line are built for distributed input/output in measuring, control and automation uses. Their compact and rugged structure with completely enclosed electronics allows the use not only in a control box but also in proximity of the process. The way of building in connection with high granularity offers the possibility to implement decentralized control solutions consistently. Through the integrated microcontroller CST modules can perform pre-processing functions independently. In many cases, they help to lower the costs for control hardware and installation while offering an enlargement of flexibility at the same time.

CST modules are available with a wide range of different functions. In addition to digital input/output with different turn-off levels, analog inputs/outputs, incremental encoders and a digital motor controller are available. A configurable logic module with network computer functionality allows the use of decentralized intelligence and the implementation of critical functions directly into the hardware.

CST devices are layouted in a modular manner. The basic element is the base module with processor 80C32, CAN controller Philips SJA1000 and 8k of ROM. The interfaces have been realized with an application module piggybacked on one side of the base module. Different application modules are available.

Control functions can be implemented efficiently by use of a programmable variation of the base module.

1.3 Sample Applications

The application area of the CST product line is very wide. Some sample application are detailed in the following:

- Remote I/O in control systems
- Modular large display systems
- Remote data processing
- Distributed measurement data acquisition
- Automation of buildings

1.4 Ordering Information

Article Number	Description
11-00-001-20	CST-DI8-TTL 8 digital input channels, TTL level
11-00-002-20	CST-DO8-TTL 8 digital output channels, TTL level
11-00-103-20	CST-DI8-24V 8 digital input channels 24V
11-00-104-20	CST-DO8H-24V/500mA 8 digital output channels, 24V/500mA
11-00-005-20	CST-AI8-8-0/10V 8 analog input channels 0-10V, 8 bit resolution
11-00-006-20	CST-AI8-8-0/10V-RO 8 analog input channels 0-10V, 8 bit resolution, reference output for potentiometer supply
11-00-007-20	CST-AI4-12-0/10V 4 analog input channels 0-10V, 12 bit resolution, galvanically separated
11-00-008-20	CST-AI4-12-0/25mA 4 analog input channels 0-25mA, 12 bit resolution, galvanically separated
11-00-009-20	CST-AO2-12-0/10V 2 analog output channels 0-10V, 12 bit resolution, galvanically separated
11-00-010-20	CST-AO2-12-0/25mA 2 analog output channels, 0-25mA, 12 bit resolution, galvanically separated
11-00-111-20	CST-II2-TTL 2 channel incremental encoder, 24 bit resolution, galvanically separated
11-00-112-20	CST-II1ED-TTL 1 channel incremental encoder, 24 bit resolution, error detection, galvanically separated
11-00-113-20	CST-MC1100 Digital motor controller for synchronous, asynchronous and stepping motors, galvanically separated
11-00-901-20	CST-MKR Clamp for CST modules, assembly rail fixing
11-00-902-20	CST-MKS Clamp for CST modules, screw fixing

2 Communication

2.1 Communication Concept

The control of the CST devices takes place through module specific variables that can be accessed by messages (COB: Communication Object) with configurable CAN identifiers (COB id's). These variables have reading and writing access. Furthermore events can be triggered when state changes occur (e.g. modification of input signals).

The devices are (complying to the CAL LMT protocol following CiA) completely configurable over the CAN bus. The assignment of COB id's takes place dynamically during the initialization of the network, the data rate is recognized by the device by means of a table containing standard data rates.

2.2 Operational States

For distinction between configuration and normal operation CST devices operate in two states, a configuration mode and an operation mode. The transitions between the operating modes are influenced through mode switching commands.

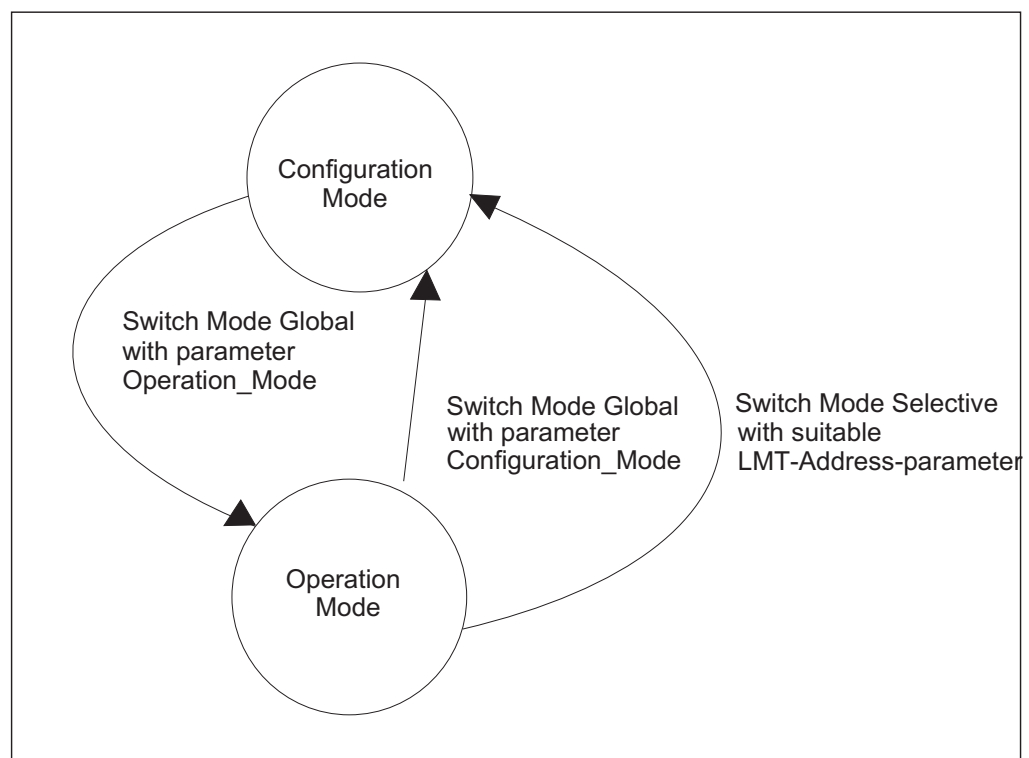


Figure 1: CST module operating states and transitions.

The common procedure after power on of the system follows the following steps:

- Switching the CST device into configuration mode
- Assignment of COB Id's for the variables to use
- Optional: offset assignment to write variables
- Switching the CST device into operation mode by using *Switch Mode Global*
- Operation of the system through the configured identifier Configuration Mode

2.3 Configuration Mode

In configuration mode COB identifiers for reading and writing operations as well as for event notification are determined for individual variables through a compatible extension of the CAL LMT protocol. The variables represent the state of the inputs and outputs and are described in the CST data sheets. Figure 2 shows the protocol for the assignment of COB id's.

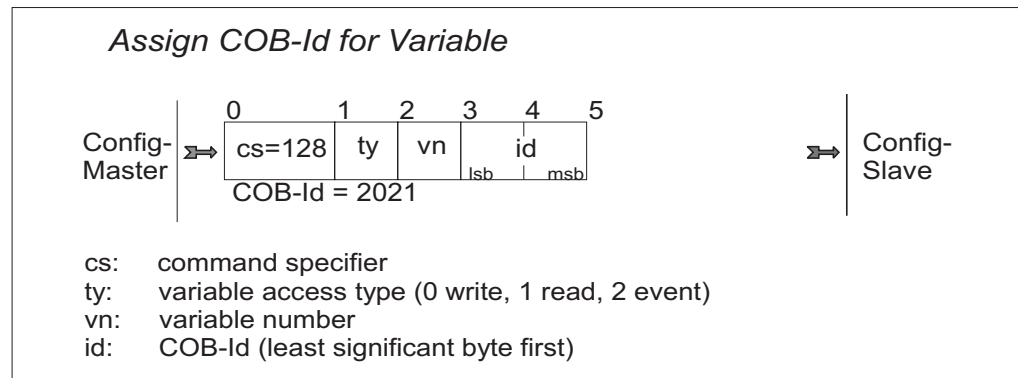


Figure 2: Assigning a COB id to a module variable

By the declaration of an offset it is possible to determine for certain write variables, which part of the data field should be evaluated. Through this mechanism it is possible to set several outputs on different CST devices by transmitting only one COB. The default offset is set to 0. Figure 3 shows the protocol used for the assignment of an offset.

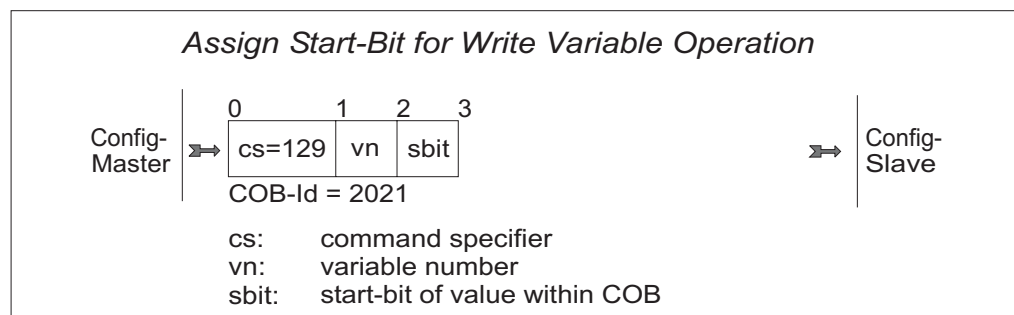


Figure 3: Assigning an offset to a module variable

2.4 Operation Mode

In operation mode the data exchange between one or more control units and CST devices takes place through the configured COB id's. Figure 4 shows the protocol sequences used in operation mode.

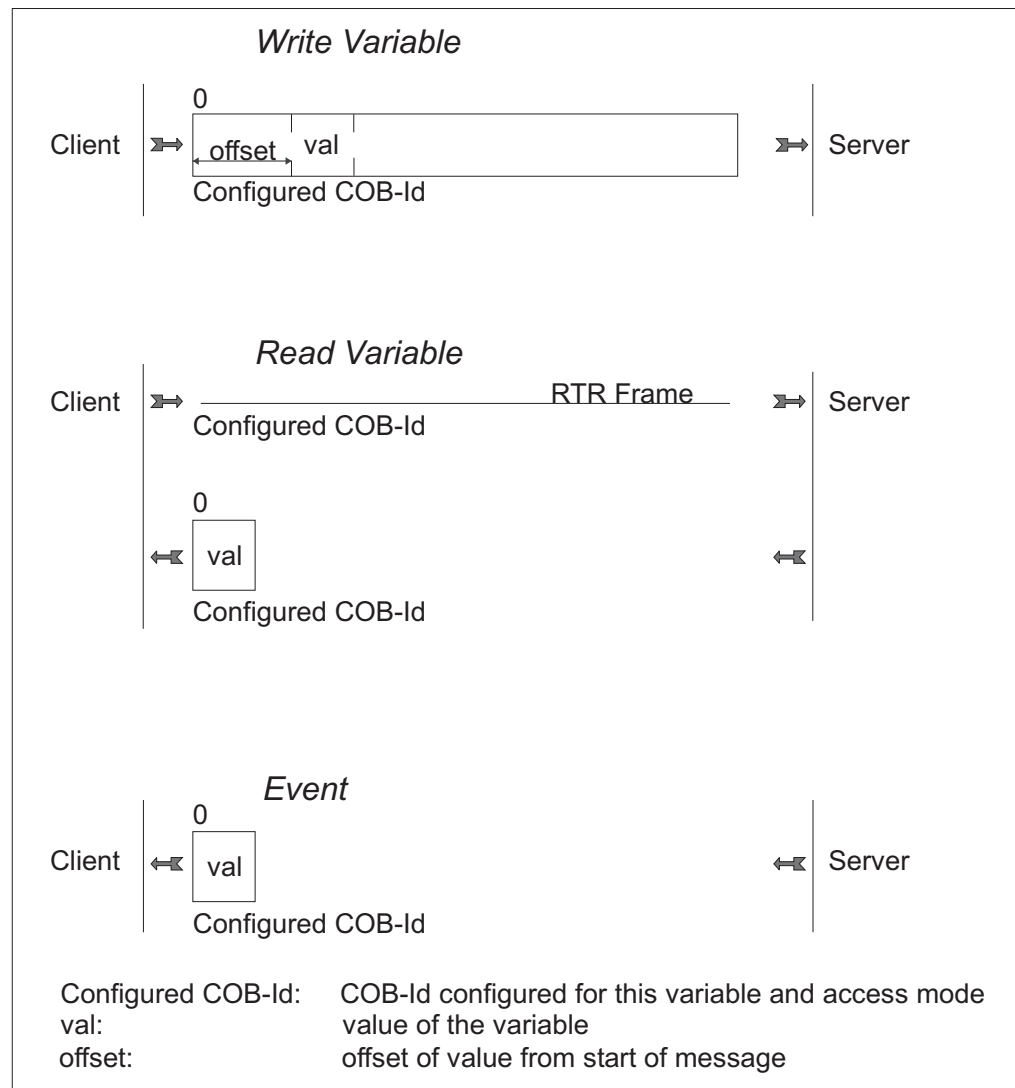


Figure 4: Protocol sequences for variable access in operation mode

With values longer than a byte the least significant byte is transmitted first, the most significant byte is transmitted last. The transmit position of a value with an offset (writing variables) is obtained by casting the value into a longer variable corresponding to the offset and then shifting it left depending on the dimension of the offset.

2.5 Mode Switching

To change the operational modes commands for mode switching are provided.

Switch Mode Selective switches the CST device specified by the address parameters into configuration mode. Figure 5 shows the protocol used to perform *switch Mode Selective*.

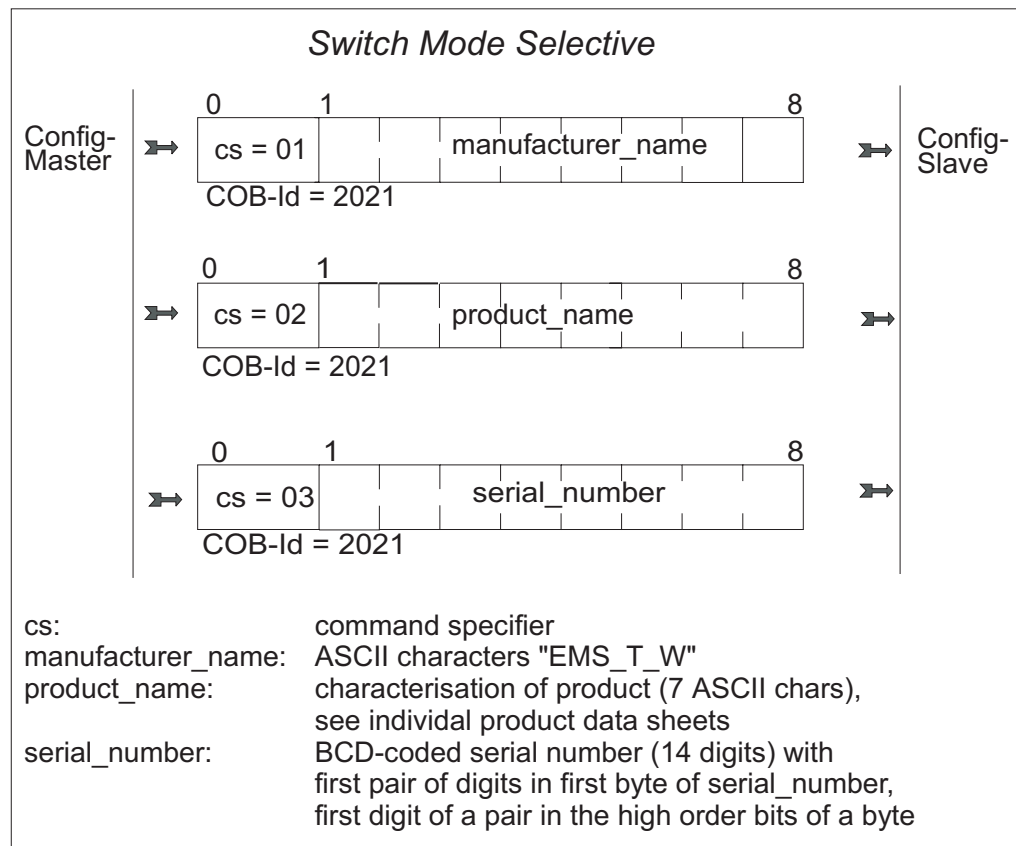


Figure 5: Protocol sequence used for Switch Mode Selective

The successive messages for *Switch Mode Selective* should be sent with a space of at least 5ms.

Switch Mode Global switches between operation mode and configuration mode for all CAL-LMT compatible modules (classes 1, 2) attached to the network. Figure 6 shows the protocol used to perform *Switch Mode Global*.

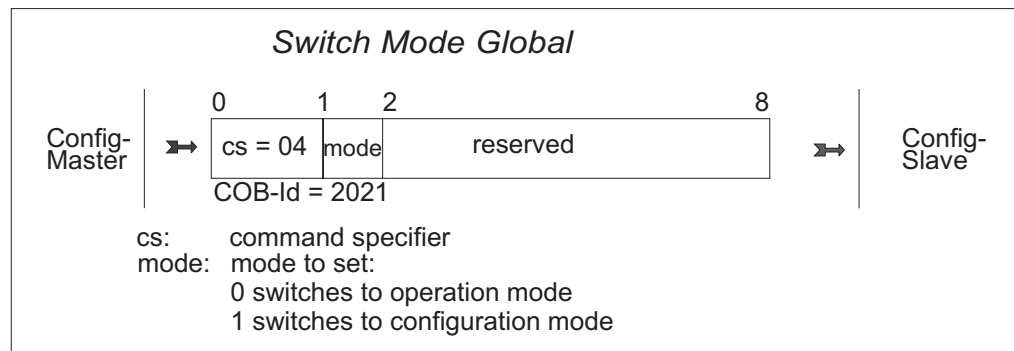


Figure 6: Protocol used for *Switch Mode Global*

2.6 Identification Services

The LMT address parameters of a device currently switched to configuration mode can be inquired. Figure 7 shows the protocol sequences used to get those parameters.

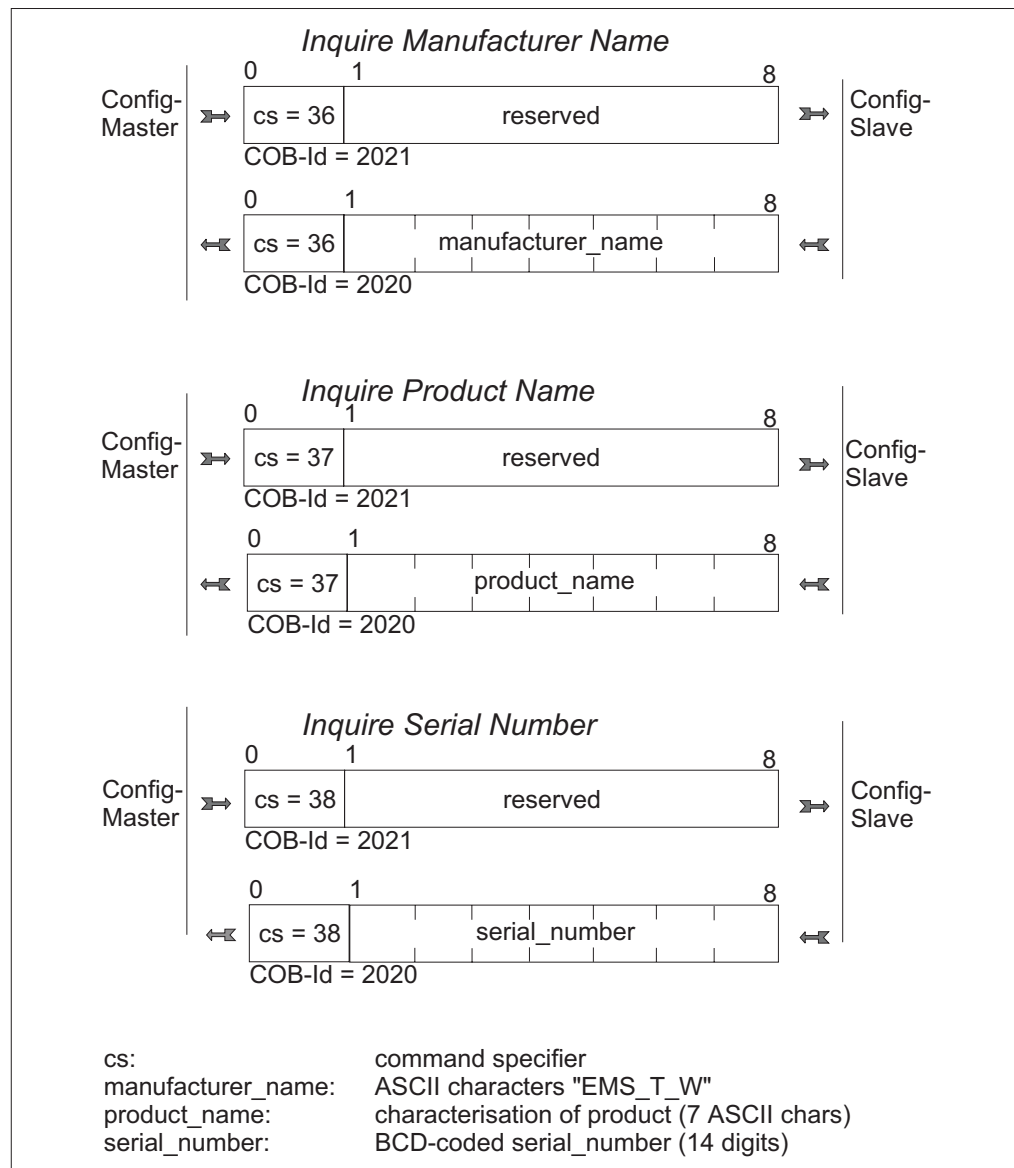


Figure 7: Protocol sequence to inquire the LMT parameters

This function can be used to identify an unknown CST device. Therefore, the device has to be operated exclusively in the CAN network and has to be switched into configuration mode by using the function *Switch Mode Global*. Afterwards an inquiry of the LMT parameters can be done.

To check the module version a function is implemented in the firmware beginning with version x.3.x that provides inquiry of the version of the hardware, the communication firmware and the module software. Figure 8 shows the protocol used to inquire the version number.

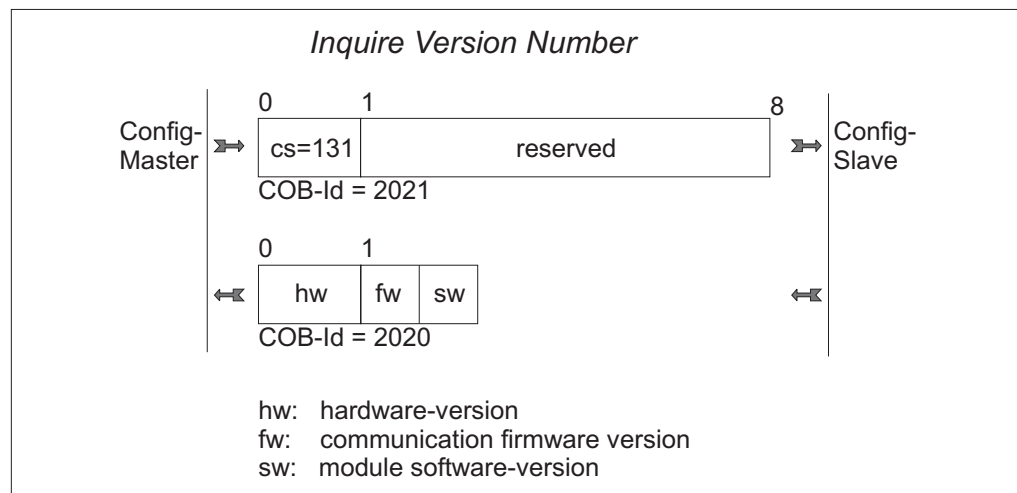


Figure 8: Protocol used for the version inquiry

2.7 Structure of the Variable Index

Control-/Status register

CST devices have a Control-/Status section, that can be accessed through variable number 0. The control section is affected by writing operations and consists of several 16 bit registers manipulated by a 5 byte message. The selection of the register to manipulate is done by the first byte of the message, the following 2 bytes contain the value to store, and the last two bytes contain a mask releasing the bits to manipulate. Only active bits (bits set to 1) in the mask can be affected in the control register.

The control register 0 contains flags influencing the behaviour of the CST device on the CAN bus. The following bits are defined (current version x.3.x):

Bit-Nr.	Function (Bit set to 1)
0	Auto Bus On The device reactivates its CAN controller, if it switched into bus off state because of errors.
1	Auto Baud The device detects the data rate, if it has been changed during operation.

The status register

Reading the status register returns a message of 4 bytes. The first two bytes contain the bus state, the following two bytes contain the module state. Changes occurring in the status register may trigger events with certain devices. The bus state currently returns a copy of the control register 0.

2.8 Configuration Example

The following configuration example shows the configuration for a CST module of type CST–DO8–24V/500mA.

General structure of a CAN message (here with 8 bytes of data):

ID	Length	Data
0x7E5	0x08	0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08

0x7E5 (= 2021 decimal) is a specific identifier used for the configuration, 0x7E4 (= 2020 decimal) is used by the module when answering to a request.

All values are hexadecimal values. Important values within the CAN messages are printed in **bold face**.

Synchronisation

CST modules perform an automatic baudrate detection for baudrates following the CiA standard. To synchronize modules connected to the bus to the required baudrate, one should send synchronisation messages, preferably with varying time intervals (0–10ms):

```
0x7E5 0x08 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08
0x7E5 0x08 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08
0x7E5 0x08 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08
0x7E5 0x08 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08
0x7E5 0x08 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08
```

Depending on the number of modules connected to the bus one should send up to 500 synchronisation messages.

Mode Switching into the Configuration Mode

There now are two possibilities to configure the modules:

1. Switch Mode Global (Condition: Only one module connected to the bus!)

0x7E5 0x02 0x04 0x01	Switch the module into configuration mode
0x7E5 0x01 0x82	Check presence of the module

If the configuration parameters are unknown, they can be inquired through the following 3 messages (time intervall about 5ms):

0x7E5 0x01 0x24	Manufacturer ("EMS_T_W")
0x7E5 0x01 0x25	Product name. ("CSTxxxx")
0x7E5 0x01 0x26	Serial number (binary coded decimal value with 7 digits)

The module should then answer with the following messages (example):

```
0x7E4 0x08 0x24 0x45 0x4D 0x53 0x5F 0x54 0x5F 0x57 ("EMS_T_W")
0x7E4 0x08 0x25 0x43 0x53 0x54 0x30 0x30 0x30 0x31 ("CST0001")
0x7E4 0x08 0x26 0x00 0x00 0x00 0x00 0x00 0x01 0x78 (00000178)
```

The different variables can now be configured (see below)

After the configuration the module has to be switched back into operating mode:

0x7E5 0x02 **0x04 0x00** Switch to operating mode

2. Switch Mode Selective (specific selection of a module connected to the bus)

Switch the module into configuration mode (time intervall about 5ms):

0x7E5 0x08 **0x01 0x45 0x4D 0x53 0x5F 0x54 0x5F 0x57** ("EMS_T_W")
 0x7E5 0x08 **0x02 0x43 0x53 0x54 0x30 0x30 0x30 0x31** ("CST0001")
 0x7E5 0x08 **0x03 0x00 0x00 0x00 0x00 0x00 0x01 0x78** (00000178)

Check presence of the device, e.g. Inquire serial number

0x7E5 0x01 **0x26** serial number

The module should then answer with the following message (example):

0x7E4 0x08 **0x03 0x00 0x00 0x00 0x00 0x00 0x01 0x78** (00000178)

The different variables can now be configured.

After the configuration the module has to be switched back into operating mode:

0x7E5 0x02 **0x04 0x00** switch to operating mode

Configuration of the Variables

To configure the module, it has to be switched into configuration mode using one of the methods deccribed above.

Now, the variables can be configured. There are 3 different ways to access the variables:

1. Write access (0): write a value to a variable (e.g. Set an output)
2. Read access (1): read a value from a variable (e.g read an input)
3. Event access (2): generates a message in case of an occuring event

Not every variable can be accessed by all of the access types described above.

The COB-Id (will be used later as the identifier of a specific messages) has to be splitted in high and low bytes before transmission.

Define COB-Id 0x14 for reading access to the byte variable (Var1: all channels):
 0x7E5 0x05 **0x80 0x01 0x01 0x14 0x00**

Define COB-Id 0x214 for reading access to the byte variable (Var1):
 0x7E5 0x05 **0x80 0x01 0x01 0x14 0x02**

Configuration of the control variable (Var0) for writing access (0) with COB 0x10
 0x7E5 0x05 **0x80 0x00 0x00 0x10 0x00**

Configuration of the status variable (Var0) for reading access (1) with COB 0x11
 0x7E5 0x05 **0x80 0x01 0x00 0x11 0x00**

Configuration of the status variable (Var0) for event access (2) with COB 0x12
 0x7E5 0x05 **0x80 0x02 0x00 0x12 0x00**

Configuration of the byte variable (Var1) for writing access (0) with COB 0x33
 0x7E5 0x05 0x80 0x00 0x01 0x33 0x00

Configuration of the byte variable (Var1) for reading access (1) with COB 0x34
 0x7E5 0x05 0x80 0x01 0x01 0x34 0x00

Now the different channels (outputs) are configured (example: 4 channels):

Configuration of the channel0 variable (Var2) for writing access (0) with COB 0x35
 0x7E5 0x05 0x80 0x00 0x02 0x35 0x00

Configuration of the channel1 variable (Var3) for writing access (0) with COB 0x36
 0x7E5 0x05 0x80 0x00 0x03 0x36 0x00

Configuration of the channel2 variable (Var4) for writing access (0) with COB 0x37
 0x7E5 0x05 0x80 0x00 0x04 0x37 0x00

Configuration of the channel6 variable (Var8) for writing access (0) with COB 0x38
 0x7E5 0x05 0x80 0x00 0x08 0x38 0x00

The configuration is finished, the module has to be switched back into operating mode:

0x7E5 0x02 0x04 0x00 Switch modul into operating mode

Verification of the configuration

Inquire the status of the module (**important: the RTR bit has to be set**)
 0x011 0x04 RTR-Frame !!

Now set the channels 2 and 6

0x033 0x01 0x22 data frame
 0x034 0x04 RTR-Frame (inquire status of the channels)

Reset all channels

0x033 0x01 0x00 data frame
 0x034 0x04 RTR-Frame (inquire status of the channels)

Set channel 0

0x035 0x01 0x01 data frame
 0x034 0x04 RTR-Frame (inquire status of the channels)

Set channel 1

0x036 0x01 0x01 data frame
 0x034 0x04 RTR-Frame (inquire status of the channels)

Set channel 2

0x037 0x01 0x01 data frame
 0x034 0x04 RTR-Frame (inquire status of the channels)

Set channel 6

0x038 0x01 0x01 data frame
 0x034 0x04 RTR-Frame (inquire status of the channels)

Configuration using an offset

During the configuration an offset can be specified to 'shift' the values within a message. This offers the possibility to access a couple of modules later at the same time using only one CAN message when in operating mode. The specific module will then evaluate the values at different positions within the CAN messages. Example:

Set an offset of 8 for the byte variable (Var 1). Thus, the second byte within a message will be valid for this module.

0x7E5 0x03 **0x81 0x01 0x08**

If the byte variable for this module is addressed later, the module will evaluate the second byte within the received CAN message. A message would have the following structure:

Set channels 2 and 6 (see example above)

0x033 0x02 **0x00 0x22** data frame

0x034 0x04 RTR-Frame (inquire status of the channels)

If the offset is not needed, this step can be omitted during configuration.

3 General Features

3.1 Connection Scheme

The CAN interface connector (D-Sub 9 male) complies to CiA standard DS 102-1. The pin usage is detailed in the following table:

Pin 1	–	Reserved by CiA
Pin 2	CAN_L	CAN_Low bus line (dominant low)
Pin 3	Gnd	Ground
Pin 4	–	Reserved by CiA
Pin 5	–	Reserved by CiA
Pin 6	(Gnd)	Optional ground, internally connected to Pin 3
Pin 7	CAN_H	CAN_High bus line (dominant high)
Pin 8	–	Reserved by CiA (error signal)
Pin 9	V+CAN	Positive power supply from CAN Bus

3.2 Absolute Limiting Values

In the following table, the limiting values of the bus interface are summarized. The application specific limiting values are stated in the different module data sheets. Any (also temporary) stress in excess of the limiting values may cause permanent damage on the devices.

Parameter	Min.	Max.	Unit
Storage temperature	– 20	+80	°C
Operating temperature *	0	+60	°C
Supply voltage **	–100	+16	V
Voltage on bus connections	– 4,7	+16	V
Current across ground connection	– 1	+1	A

* Extended temperature range upon request

** V+CAN

Note: Modules marked **VS24** on the name plate are layouted for differing supply voltages.

3.3 Nominal Values

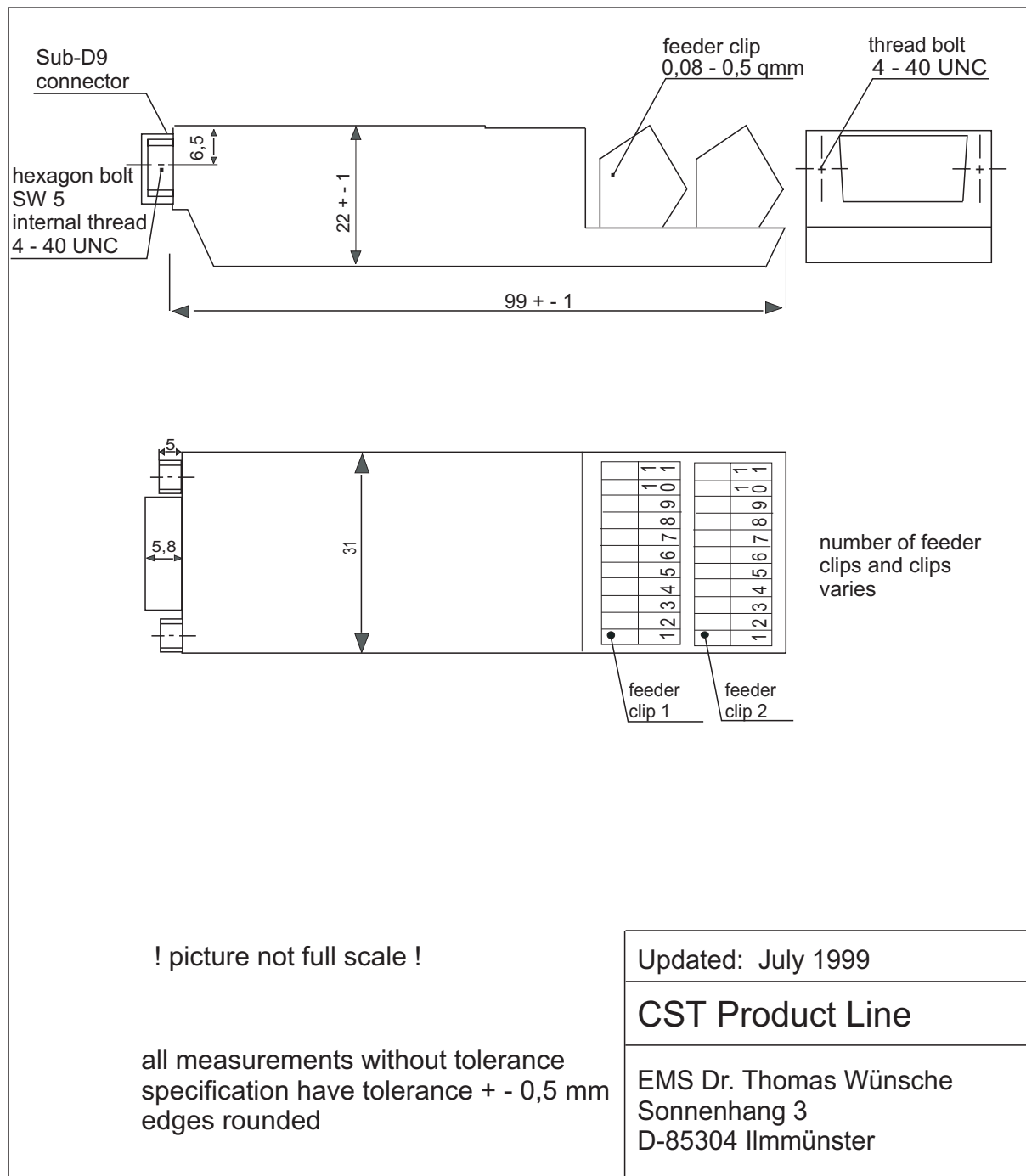
The following table shows the nominal values of the CST product line

Parameter	Min.	Typ.	Max.	Unit
Current consumption (logic)	–	75	110	mA
Supply voltage*	+ 7	–	+ 14	V
Bus data rate	–	10, 20, 50, 100, 125, 250, 500, 800, 1000	–	kBit/s

* V+CAN

3.4 Measurements

The module descriptions can be obtained from the specific module datasheets



CST Digital Module with 8 Inputs 24V

Features

- 8 digital input channels 24V
- 2 terminal blocks with 10 clamps for wiring
- Signals input level changes

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Chan_0	Input channel 0
2	Chan_1	Input channel 1
3	Chan_2	Input channel 2
4	Chan_3	Input channel 3
5	Chan_4	Input channel 4
6	Chan_5	Input channel 5
7	Chan_6	Input channel 6
8	Chan_7	Input channel 7
9	—	Reserved, do not connect
10	Gnd	Common ground for CAN bus and CST node

Terminal Block 2 (outer block)

Clamp	Name	Function
1 -9	—	These clamps are connected internally. They can be connected either to 24V or to ground potential,
10	Gnd	Common ground for CAN bus and CST node

Operation Indication

The meaning of the different indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator.

Position	Colour	Function
1	green	Switching condition channel 0
2	green	Switching condition channel 1
3	green	Switching condition channel 2
4	green	Switching condition channel 3
5	green	Switching condition channel 4
6	green	Switching condition channel 5
7	green	Switching condition channel 6
8	green	Switching condition channel 7
10	red	Module initialization successful

CAN Communication

The module is accessed by 1 write, 10 read and 9 event variables. The message id's for the variable access are assigned during the the configuration (see CST product line manual).

LMT-Address

The module with 12V supply has the LMT product name **CST0003**.

The module with 24V supply has the LMT product name **CST1003**.

Index of the Variables

Variable	Nr.	Length	Access	Description
Control	0	5 byte	write	Write to control registers
Status	0	1 byte	read	Read the status
All_Chans	1	1 byte	read/event	Read all channels, status change of at least one channel
Chan_0	2	1 byte	read/event	Read/Status change of channel 0
Chan_1	3	1 byte	read/event	Read/Status change of channel 1
Chan_2	4	1 byte	read/event	Read/Status change of channel 2
Chan_3	5	1 byte	read/event	Read/Status change of channel 3
Chan_4	6	1 byte	read/event	Read/Status change of channel 4
Chan_5	7	1 byte	read/event	Read/Status change of channel 5
Chan_6	8	1 byte	read/event	Read/Status change of channel 6
Chan_7	9	1 byte	read/event	Read/Status change of channel 7

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line manual.

Nominal Values

Parameter	Minimum	Typical	Maximum	Unit
Threshold voltage of input stage	—	5	—	V
Hysteresis	—	0,5	—	V

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Minimum	Maximum	Unit
Input voltage	0	30	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

CST Digital Module with 8 Outputs 24V/500mA

Features

- 8 digital output channels with 24V/500mA switching power
- 2 terminal blocks with 11 clamps for wiring
- Monitoring of the supply voltage within the power circuit
- Short circuit and overload-proof outputs

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Chan_0	Output channel 0
2	Chan_1	Output channel 1
3	Chan_2	Output channel 2
4	Chan_3	Output channel 3
5	Chan_4	Output channel 4
6	Chan_5	Output channel 5
7	Chan_6	Output channel 6
8	Chan_7	Output channel 7
9	—	Reserved, do not connect
10	Gnd	Common Ground for CAN bus and CST node
11	V+	Positive supply power circuit

Terminal Block 2 (outer block)

Clamp	Name	Function
1 – 9	—	These clamps represent the second connection for the load. Connected to ground potential.
10	Gnd	Common Ground for CAN bus and CST node
11	V+	Positive supply power circuit

Operation Indication

The meaning of the different indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator.

Position	Colour	Function
1	green	Switching condition channel 0
2	green	Switching condition channel 1
3	green	Switching condition channel 2
4	green	Switching condition channel 3
5	green	Switching condition channel 4
6	green	Switching condition channel 5
7	green	Switching condition channel 6
8	green	Switching condition channel 7
10	red	Supply voltage for the logic connected
11	red	Supply voltage for the output stages is connected. This indicator is not updated during the baudrate detection procedure. Changes when connecting or disconnecting the power supply indicate a correct baudrate detection.

CAN Communication

The module is accessed by 10 write, 10 read and 1 event variable. The message id's for the variable access are assigned during the configuration (see CST product line manual).

LMT Address

The module with 12V supply has the LMT product name **CST0001**.

The module with 24V supply has the LMT product name **CST1001**.

Index of the variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	write	Write to control registers
Status	0	4 Byte	read	Read the status
All_Chan	1	1 Byte	write/read	Write/Read all channels
Chan_0	2	1 Byte	write/read	Write/Read channel 0
Chan_1	3	1 Byte	write/read	Write/Read channel 1
Chan_2	4	1 Byte	write/read	Write/Read channel 2
Chan_3	5	1 Byte	write/read	Write/Read channel 3
Chan_4	6	1 Byte	write/read	Write/Read channel 4
Chan_5	7	1 Byte	write/read	Write/Read channel 5
Chan_6	8	1 Byte	write/read	Write/Read channel 6
Chan_7	9	1 Byte	write/read	Write/Read channel 7

Registers of the Control Section

The control section of the modules consists of 4 registers:

- Register 0 contains bus specific flags and is described in the CST product line manual;
- Register 1 is not used;
- Register 2 contains module specific flags shown in the following table;
- Register 3 represents a mask, the bits of which enable the event triggering in case of a change of the module specific status (default: all events disabled).

Bit	Function
0	reserved
1	Enable output, if supply voltage for the power circuit in 12V mode is connected
2	Enable output, if supply voltage for the power circuit in 24V mode is connected (default)

Registers of the Status Section

The structure of the status registers is described in the CST product line configuration manual. The occupancy of the module specific part is shown in the following table.

Bit	Event	Function
0	—	reserved
1	yes	Supply voltage for the power circuit in 12V mode is connected
2	yes	Supply voltage for the power circuit in 24V mode is connected
3	—	reserved
4	yes	Output stage is enabled

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Supply voltage V+	8	12/24	28	V
Output current (per channel)	0		500	mA
Reduction of total current at environmental temperature > 40°C	—	100	—	mA/°C
Threshold value to enable Output in 12V mode	—	10	—	V
Threshold value to enable Output in 24V mode	—	20	—	V

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Supply voltage V+	0	30	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

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CST Digital Module with 8 Inputs TTL Level

Features

- 8 digital input channels with TTL level
- 2 terminal blocks with 10 clamps for wiring
- Signals input level changes

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Chan_0	Input channel 0
2	Chan_1	Input channel 1
3	Chan_2	Input channel 2
4	Chan_3	Input channel 3
5	Chan_4	Input channel 4
6	Chan_5	Input channel 5
7	Chan_6	Input channel 6
8	Chan_7	Input channel 7
9	—	Reserved, do not connect
10	Gnd	Common ground for CAN bus and CST node
11	ExtPWR	Power supply +5V for external logic

Terminal Block 2 (outer block)

Clamp	Name	Function
1 -- 10	Gnd	Common ground for CAN bus and CST node
11	ExtPWR	Power supply +5V for external logic

Operation Indication

The meaning of the different indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator.

Position	Colour	Function
1	green	Switching condition channel 0
2	green	Switching condition channel 1
3	green	Switching condition channel 2
4	green	Switching condition channel 3
5	green	Switching condition channel 4
6	green	Switching condition channel 5
7	green	Switching condition channel 6
8	green	Switching condition channel 7
10	red	Internal supply voltage connected
11	red	Supply voltage for external logic connected

CAN Communication

The module is accessed by 1 write, 10 read and 9 event variables. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT-Address

The module has the LMT product name **CST0009**.

Index of the Variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	Write	Write to control registers
Status	0	1 Byte	Read	Read the status
All_Ch	1	1 Byte	Read/Event	Read all channels, status change of at least one channel
Chan_0	2	1 Byte	Read/Event	Read/Status change channel 0
Chan_1	3	1 Byte	Read/Event	Read/Status change channel 1
Chan_2	4	1 Byte	Read/Event	Read/Status change channel 2
Chan_3	5	1 Byte	Read/Event	Read/Status change channel 3
Chan_4	6	1 Byte	Read/Event	Read/Status change channel 4
Chan_5	7	1 Byte	Read/Event	Read/Status change channel 5
Chan_6	8	1 Byte	Read/Event	Read/Status change channel 6
Chan_7	9	1 Byte	Read/Event	Read/Status change channel 7

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line manual.

Nominal Values

Parameter	Minimum	Typical	Maximum	Unit
Threshold voltage of input stage	0,8	—	2,4	V

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Input voltage	0	5	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

CST Digital Module with 8 Outputs TTL Level

Features

- 8 digital outputs with TTL level
- 2 terminal blocks with 11 clamps for wiring

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Chan_0	Output switch channel 0
2	Chan_1	Output switch channel 1
3	Chan_2	Output switch channel 2
4	Chan_3	Output switch channel 3
5	Chan_4	Output switch channel 4
6	Chan_5	Output switch channel 5
7	Chan_6	Output switch channel 6
8	Chan_7	Output switch channel 7
9	—	Reserved, do not use
10	Gnd	Common ground for CAN bus and process
11	ExtPWR	Power supply +5V for external logic (output)

Terminal Block 2 (outer block)

Clamp	Name	Function
1 – 10	Gnd	Common ground for CAN bus and process
11	ExtPWR	Power supply +5V for external logic (output)

Operation Indication

The meaning of the different indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator.

Position	Colour	Function
1	green	Switching condition channel 0
2	green	Switching condition channel 1
3	green	Switching condition channel 2
4	green	Switching condition channel 3
5	green	Switching condition channel 4
6	green	Switching condition channel 5
7	green	Switching condition channel 6
8	green	Switching condition channel 7
10	red	Internal power supply connected
11	red	Power supply for external logic connected

CAN Communication

The module is accessed by 10 write, 10 read and 1 event variable. The message id's for the variable access are assigned during the configuration (see CST product line manual).

LMT-Address

The module has the LMT product name **CST0010**.

Index of the Variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	Write	Write to control register
Status	0	4 Byte	Read/Event	Read/change of status
All_Chans	1	1 Byte	Write/Read	Write/read all channels
Chan_0	2	1 Byte	Write/Read	Write/read channel 0
Chan_1	3	1 Byte	Write/Read	Write/read channel 1
Chan_2	4	1 Byte	Write/Read	Write/read channel 2
Chan_3	5	1 Byte	Write/Read	Write/read channel 3
Chan_4	6	1 Byte	Write/Read	Write/read channel 4
Chan_5	7	1 Byte	Write/Read	Write/read channel 5
Chan_6	8	1 Byte	Write/Read	Write/read channel 6
Chan_7	9	1 Byte	Write/Read	Write/read channel 7

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line manual.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Output current (low, $V = 0,6V$)	—	—	5	mA
Output current (high, $V = 2,4V$)	—	—	5	mA

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Output current (low)	—	20	mA
Output current (high)	—	20	mA
Sum of all output currents	—	50	mA

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

CST Analogue Module with 8 Inputs 0-10V

Features

- 8 analogue inputs 0-10V with 8 bits resolution
- 2 terminal blocks with 10 clamps for wiring
- Synchronous scanning of all channels
- Reference output 10V
(only Version CST-AI8-8-0/10V-RO)

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Chan_0	Input channel 0
2	Chan_1	Input channel 1
3	Chan_2	Input channel 2
4	Chan_3	Input channel 3
5	Chan_4	Input channel 4
6	Chan_5	Input channel 5
7	Chan_6	Input channel 6
8	Chan_7	Input channel 7
9	—	Reserved, do not connect
10	RefOut	Reference output 10V (only version CST-AI8-8-0/10V-RO)

Terminal Block 2 (outer block)

Clamp	Name	Function
1 – 10	Gnd	Common ground for CAN bus and CST node

Operation Indication

The meaning of the different operation indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator.

Position	Colour	Function
9	red	Module initialized correctly

CAN Communication

The module is accessed by 1 write and 10 read variables. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual)

LMT Address

The module has the LMT product name **CST0011**.

The module with reference output (RO) has the LMT product name **CST0007**.

Index of the Variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	write	Write to control registers
Status	0	1 Byte	read	Read the status
All_Chans	1	8 Byte	read	Read all channels with synchronized scanning
Chan_0	2	1 Byte	read	Read channel 0
Chan_1	3	1 Byte	read	Read channel 1
Chan_2	4	1 Byte	read	Read channel 2
Chan_3	5	1 Byte	read	Read channel 3
Chan_4	6	1 Byte	read	Read channel 4
Chan_5	7	1 Byte	read	Read channel 5
Chan_6	8	1 Byte	read	Read channel 6
Chan_7	9	1 Byte	read	Read channel 7

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line configuration manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line configuration manual.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Reference output (at 25°C, version RO)	9,970	10	10,030	V
Channel deviation compared to the reference	– 1	—	1	Bit
Temperature drift of the reference	– 100	—	100	ppm/°C

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Input voltage	0	30	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

CST Analogue Module with 4 Inputs 0-25mA/12 Bit

Features

- 4 analogue inputs with 0-25mA input range and 12 bit resolution
- Accuracy 0,2%
- Sample Time <1ms per channel
- Galvanic separation between bus and process ground

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Chan_0	Input channel 0
2	AGnd	Process ground
3	Chan_1	Input channel 1
4	AGnd	Process ground
5	Chan_2	Input channel 2
6	AGnd	Process ground
7	Chan_3	Input channel 3
8	AGnd	Process ground
9	AGnd	Process ground
10	V+	Positive voltage supply (input , 24V)

Terminal Block 2 (outer block)

Clamp	Name	Function
1	V+	Positive voltage supply (input , 24V)
2	AGnd	Process ground
3	V+	Positive voltage supply (input , 24V)
4	AGnd	Process ground
5	V+	Positive voltage supply (input , 24V)
6	AGnd	Process ground
7	V+	Positive voltage supply (input , 24V)
8	AGnd	Process ground
9	AGnd	Process ground
10	V+	Positive voltage supply (input , 24V)

All clamps AGnd are internally connected. All clamps V+ are internally connected. All voltages on the terminal blocks relate to AGnd.

Operation Indication

Position	Colour	Funktion
10	rot	Internal supply is connected
11	rot	Supply for the process side is connected

CAN Communication

The module is accessed by 1 write and 6 read variables. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT Address

The module has the LMT product name **CST0005**.

Index of the Variables

Variable	Nr.	Length	Access	Bedeutung
Control	0	5 Byte	write	Write to control registers
Status	0	4 Byte	read	Read the status
All_Chans	1	8 Byte	read	Read all channels
Chan_0	2	2 Byte	read	Read channel 0
Chan_1	3	2 Byte	read	Read channel 1
Chan_2	3	2 Byte	read	Read channel 2
Chan_3	5	2 Byte	read	Read channel 3

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line configuration manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line configuration manual.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Power supply V+	20	24	28	V
Input load	159,30	159,55	159,80	Ohm
measurement error related to maximum deflection *	—	—	0,2	%
Temperature drift *	- 100	—	100	ppm/°C

* modules with higher accuracy on demand

Furthermore the nominal values values specified within the chapter 'General Features' have to be considered.

Limiting values

Parameter	Min.	Max.	Unit
Power supply	0	30	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

CST Analogue Module with 4 Inputs 0-10V/12 Bit

Features

- 4 analogue inputs with 0-10V input range and 12 Bit resolution
- Accuracy 0,2%
- Sampling time <1ms per channel
- Galvanic separation between bus and process ground

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Chan_0	Input channel 0
2	AGnd	Process ground
3	Chan_1	Input channel 1
4	AGnd	Process ground
5	Chan_2	Input channel 2
6	AGnd	Process ground
7	Chan_3	Input channel 3
8	AGnd	Process ground
9	AGnd	Process ground
10	V+	Positive voltage supply (24V)

Terminal Block 2 (outer block)

1	V+	Positive voltage supply (24V)
2	AGnd	Process ground
3	V+	Positive voltage supply (24V)
4	AGnd	Process ground
5	V+	Positive voltage supply (24V)
6	AGnd	Process ground
7	V+	Positive voltage supply (24V)
8	AGnd	Process ground
9	AGnd	Process ground
10	V+	Positive voltage supply (24V)

All clamps AGnd are internally connected. All clamps V+ are internally connected.

Operation Indication

The meaning of the different operation indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator LED.

Position	Colour	Function
10	red	Internal power supply connected
11	red	Power supply for the process side connected

CAN Communication

The module is accessed by 1 write and 6 read variables. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT Address

The module has the LMT product name **CST0014**.

Index of the Variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	write	Write to control registers
Status	0	4 Byte	read	Read the status
All_Chan	1	8 Byte	read	Sample all channels
Chan_0	2	2 Byte	read	Sample channel 0
Chan_1	3	2 Byte	read	Sample channel 1
Chan_2	4	2 Byte	read	Sample channel 2
Chan_3	5	2 Byte	read	Sample channel 3

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line configuration manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line configuration manual.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Voltage supply V+	20	24	28	V
Internal resistance	—	25	—	kOhm
Measurement error related to the maximum deflection *	—	—	0,2	%
Temperature drift *	- 100	—	100	ppm/°C

* Modules with higher accuracy upon request

Furthermore the nominal values specified within the chapter 'General Features' have to be considered

Limiting Values

Parameter	Min.	Max.	Unit
Voltage supply V+	0	30	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered

CST Analogue Module with 2 Outputs 0-25mA/12 Bit

Features

- 2 analogue outputs with 0-25mA output range and 12 bit resolution
- Accuracy 0,2% within signal range 4-20mA
- Galvanic separation between bus and process ground

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	AGnd	Process ground
2	Chan_0	Output channel 0
3	V+	Positive voltage supply (input , 24V)
4	AGnd	Process ground
5	Chan_1	Output channel 1
6	V+	Positive voltage supply (input , 24V)
7	AGnd	Process ground
8	AGnd	Process ground
9	V+	Positive voltage supply (input , 24V)
10	V+	Positive voltage supply (input , 24V)

All clamps AGnd are internally connected. All clamps V+ are internally connected. All voltages on the terminal blocks relate to AGnd.

Terminal Block 2 (outer block) N/A.

Operation Indication

The meaning of the different operation indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator LED.

Position	Colour	Function
8	red	Internal power supply connected
9	red	Power supply for the process side connected

CAN Communication

The module is accessed by 4 write and 1 read variables. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT Address

The module has the LMT product name **CST0006**.

Index of the variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	Write	Write to control registers
Status	0	4 Byte	Read	Read the status
All_Chan	1	4 Byte	Write	Write all channels
Chan_0	2	2 Byte	Write	Write channel 0
Chan_1	3	2 Byte	Write	Write channel 1

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line configuration manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line configuration manual.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Maximum signal range	0	—	25	mA
Nominal (accurat) signal range	4	—	20	mA
Power supply V+	20	24	28	V
Measurement error within nominal signal range related to maximum deflection * (at 25°C)	—	—	0,2	%
Temperature drift *	−100	—	100	ppm/°C
Load (at nominal supply)	0	—	800	Ohm

* Module with higher accuracy on demand

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Power supply V+	0	30	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

CST Analogue Module with 2 Outputs 0-10V/12 Bit

Features

- 2 analogue outputs with 0-10V output range and 12 Bit resolution
- Accuracy 0,2%
- Galvanic separation of bus and process ground

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	AGnd	Process ground
2	Chan_0	Output channel 0
3	V+	Positive voltage supply (24V)
4	AGnd	Process ground
5	Chan_1	Output channel 1
6	V+	Positive voltage supply (24V)
7	AGnd	Process ground
8	AGnd	Process ground
9	V+	Positive voltage supply (24V)
10	V+	Positive voltage supply (24V)

All clamps AGnd are connected internally. All clamps V+ are internally connected.

Terminal Block 2 (outer block) N/A.

Operation Indication

The meaning of the different indicators is shown within the following table. The position of the indicators refer to the clamp mounted at the same height as the indicator.

Position	Colour	Function
8	red	Module has initialized correctly
9	red	Supply voltage for the power circuit is connected

CAN Communication

The module is accessed by 4 write and 1 read variable. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT Address

The module has the LMT product name **CST0008**.

Index of the variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	write	Write to control registers
Status	0	4 Byte	read	Read the status
All_Chans	1	4 Byte	write	Write to all channels
Chan_0	2	2 Byte	write	Write to channel 0
Chan_1	3	2 Byte	write	Write to channel 1

Registers of the Control Section

The control section only contains the module specific flags described in the CST product line manual.

Registers of the Status Section

The status section only contains the module specific flags described in the CST product line manual.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Supply voltage V+	20	24	28	V
Output current	0	—	20	mA
Output error (at 25°C)	—	—	0,2	%

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Supply voltage V+	0	30	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

CST Motor Control Module MC-1100

Features

- Digital motor controller based on the HCTL-1100 (Hewlett Packard) for DC-, AC synchron and AC asynchronous motors as well as step motors with incremental input
- Regulating output analogue or PWM
- Galvanic separation between bus and process ground

Assignment of the Terminal Blocks

Terminal Block 1 (inner Block)

Clamp	Name	Function
1	Ana_Out	Analogue voltage output to the inverter
2	Chan_A	Incremental input A
3	Chan_B	Incremental input B
4	PWM	PWM output
5	V+	Positive power supply (input, 24V)
6	End_L	Limit switch left
7	End_R	Limit switch right
8	Ref	Reference switch
9	Ready	Readiness signal from output stage
10	AGnd	Process ground
11	V+	Positive power supply (input, 24V)

Terminal Block 2 (outer block)

Clamp	Name	Function
1	AGnd	Process ground
2	Chan_C	Incremental input C
3	AGnd	Process ground
4	Ph_A/DIR	Phase A/rolling direction
5	Ph_B	Phase B
6	Ph_C	Phase C
7	Ph_D	Phase D
8	Enable	Output stage enable
9	V+	Positive power supply (input, 24V)
10	AGnd	Process ground
11	V+	Positive power supply (input, 24V)

Alle clamps Agnd are internally connected. All clamps V+ are internally connected

Specification of the used values

Ana_Out	Analogue regulation signal ± 10 V for the output stage
Chan_A/Chan_B	Phase signale of the incremental input, TTL level
Chan_C	Index signal of the incremental input, TTL level
PWM	Pulse width modulated signal for the output stage, TTL level
End_L/End_R	Limiting switch input (left, right), 24V (normally closed)
Ref	Reference switch input 24V
Ready	Readiness signal output stage, input 24V
Ph_A/DIR	TTL output, function depends on configuration bit M1
Ph_B/Ph_C/Ph_D	Phase outputs B, C, D for synchronous machines, TTL level
Enable	Output stage enable, output 24 V

Operation Indication

The module has no operation LEDs

CAN Communication

The module is accessed by 3 write, 3 read and 2 event variables. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT Address

The module has the LMT product name **CST1004**.

Index of the Variables

Variable	Nr.	Length	Access	Description
Control	0	5 Byte	Write	Write to control registers
Status	0	4 Byte	Read/Event	Read status
Command	1	1 – 7 Byte ¹	Write	Execute a command
Result	1	1 – 3 Byte ¹	Read/Event	Read the result
Param	2	1 – 3 Byte ¹	Write	Transfer new parameters
Position	2	3 Byte	Read/Event	Read the current position

¹ The number of transferred bytes depends on the parameters of the specified command.

Description of the Variables

Apart from the bus specific flags (see CST Product Line configuration manual) the control register also contains module specific flags within subregister 2. The bits have the following meaning:

Name	Bit-Nr.	Description
Mode_0	0	M0 = 1: output signal on Ana_Out is valid M0 = 0: output signal on PWM is valid
Mode_1	1	M1 = 0: output PhA/Dir is direction output M1 = 1: output PhA/Dir is phase output
Enable	2	Enable external output stage
Reset	3	Reset line of the HCTL-1100
Indx_Pol	4	active level of the Chan_C input 1: High Active 0: Low Active
Ref_Pol	5	active level of the reference switch input 1: High Active 0: Low Active

The status register contains an image of the control register within the module specific 2 status bytes. In addition, the status register also contains the following status bits:

Name	Bit-Nr.	Description
Do_Ref	7	Reference run is active
Endsch_rechts	8	Limiting switch right
Endsch_links	9	Limiting switch left
Index	10	Status of the incremental input Chan C
Bereit	11	Readiness signal from the output stage
Referenzsch.	12	Reference switch
Profile	13	Profile line of the HCTL-1100
Init	14	Init line of the des HCTL-1100
Limit	15	Limit line of the HCTL-1100

The command and the appropriate parameters are written to the command register. The command itself is written to data byte 0, the parameters are written to the following data bytes. Please notice that the number of parameters depend on the specified command.

Table with Commands and appropriate Parameters:

CMD	Description	Parameter
1	Write to HCTL register	UNSIGNED8 register, UNSIGNED8 value
2	Read from HCTL register	UNSIGNED8 register
3	Initialize HCTL filter	UNSIGNED8 Pol_A, UNSIGNED8 Pol_B, UNSIGNED8 Gain, UNSIGNED8 Sample_Time
4	Position Control Mode	–
5	Trapez Move Mode	UNSIGNED16 acceleration, UNSIGNED8 max_velocity, INTEGER24 final_position
6	Integral Velocity Mode	UNSIGNED16 acceleration, INTEGER8 command_velocity
7	Proportional Velocity Model	INTEGER16 command_velocity
8	Initiate reference run	UNSIGNED16 acceleration, INTEGER8 command_velocity, INTEGER8 mode
9	Init Mode	–

Description of the Reference Run:

The module can perform an automatic reference run. The used mode 'Integral Velocity Mode'. The parameters needed for the reference run are 'acceleration' and 'command_velocity'. The following limiting switch inputs can be chosen by means of the parameter 'mode':

- mode = 0: only Chan_C
- mode = 1: only Ref
- mode = 2: Chan_C and Ref

Please consider that both inputs can be switched to 'high active' or 'low active' via the control register. The default value is 'high active'

- When the command is executed, the module runs the motor with the specified parameters in one direction until a limiting switch becomes active according to the chosen mode. In mode 2, the module waits for the 'ref' input to become active.
- Now the motor runs in the opposite direction with the lowest velocity, until the switch becomes inactive again. In mode 2 the module will run the motor until the 'Ref' input becomes inactive **and** the Chan_C input becomes active, too.
- The reached position is held within the 'Position Control Mode', the 'Actual Position' register is initialized to 0.
- During the reference run, bit 7 within the module specific status word is set.
- A command issued during an active reference run is executed by the module and the reference run is interrupted. The following exceptions apply: The commands 'Write to HCTL register' and 'Read from HCTL register' are executed without interrupting the reference run. the command 'Initialize HCTL filter' is discarded.

The result register holds the result of a command execution. The first byte contains the number of the command. If an error occurred, the following additional bits are set:

7	Command syntax error	<ul style="list-style-type: none"> – Message length too short – erroneous command code
8	Command error	<ul style="list-style-type: none"> – ‘Trapez Move’ command is not executed when the ‘PROF’ bit is set – after command ‘Init-Mode’ the HCTL 1100 didn’t switch to ‘Init-Mode’ – the ‘Init Filter’ command can only be executed if the preceding command permits filtering. A preceding reference run does not allow filtering

New parameters for the command ‘Position Control’, ‘Trapez Move’, ‘Integral Velocity’ and ‘Proportional Velocity’ can be passed via the ‘Param’ register.

The ‘Position’ register holds the actual position.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Power supply V+	20	24	28	V
Input current Limit_L, Limit_R, Ready	—	3	5	mA
Input current Ref	—	5	8	mA

Furthermore the nominal values specified within the chapter ‘General Features’ have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Supply voltage V+	0	30	V
Input current Limit_L, Limit_R, Ready, Ref	0	30	V
Output current ‘Enable output stage’	—	1	mA
Output current AnaOut	—	8	mA

Furthermore the limiting values specified within the chapter ‘General Features’ have to be considered.

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CST Incremental Encoder Module with 2 Input Channels

Features

- 2 incremental inputs TTL level
- Counting range 24 Bit
- Signals changes of input levels
- Signals changes of range transgression
- Galvanic separation of CAN ground and process ground

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Ph_0A	Channel 0 phase A
2	Ph_0B	Channel 0 phase B
3	Ph_0C	Channel 0 phase C
4	Ph_1C	Channel 0 phase C
5	Ph_1B	Channel 0 phase B
6	Ph_1A	Channel 0 phase A
7	—	Reserved, do not connect
8	—	Reserved, do not connect
9	ExtPWROut	Power supply (+5V) for external logic (output!)
10	AGnd	Process ground
11	V+	Power supply for process logic (input!)

All voltage of terminal block 1 refer to AGnd

Terminal Block 2 (outer block) N/A

Operation Indication

The meaning of the different indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator.

Position	Colour	Function
10	red	Internal power supply connected
11	red	Power supply for external logic connected

CAN Communication

The module is accessed by 2 write, 4 read and 1 event variable. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT Address

The module has the LMT product name **CST1012**.

Index of the Variables

Variable	No.	Length	Access	Description
Control	0	5 byte	Write	Write to control registers
Status	0	4 byte	Read/Event	Read the status
Command	1	4 byte	Write	Execute a command
All_Chan	1	6 byte	Read	Read position of all channels
Chan_0	2	3 byte	Read	Read position of channel 0
Chan_1	3	3 byte	Read	Read position of channel 1

Registers of the Control Section

In addition to the bus specific flags (see CST product line configuration manual) the control section of the module also contains module specific flags in subregister 2. The bits are shown in the following table.

Name	Bit-no.	Description
Clear_0	0	Reset counter 0
Clear_1	1	Reset counter 1

The module specific part of the status register contains the signals shown in the following table:

Name	Bit-no.	Description
InLim_0	0	Channel 0 within allowed range
InLim_1	1	Channel 1 within allowed range
LoLim_0	2	Channel 0 has fallen below the lower limit
HiLim_0	3	Channel 0 has exceeded the upper limit
LoLim_1	4	Channel 1 has fallen below the lower limit
HiLim_1	5	Channel 1 has exceeded the upper limit
Ph_0A	9	Phase signal A of channel 0
Ph_0B	10	Phase signal B of channel 0
Ph_0C	11	Phase signal C of channel 0
Ph_1A	13	Phase signal A of channel 1
Ph_1B	14	Phase signal B of channel 1
Ph_1C	15	Phase signal C of channel 1

Commands and their corresponding parameters are written to the command register and executed after writing. For this purpose a command is written to data byte 0 and the parameters are written to the following data bytes. The following table contains the possible commands and parameters.

CMD	Description	Parameter
0	Set lower limit channel 0	UNSIGNED24 LoLim_0
1	Set upper limit channel 0	UNSIGNED24 HiLim_0
2	set lower limit channel 1	UNSIGNED24 LoLim_1
3	set upper limit channel1	UNSIGNED24 HiLim_1

Note: The position data is internally handled as an unsigned 24 bit value. Any underflow or overflow results in an erroneous evaluation of the limits. It is therefore recommended to set the zero point outside of the area of operation.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Threshold of the input stage	0,8	—	2,4	V

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Input voltage	0	5	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

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CST Incremental Input Module with Error Detection

Features

- 1 incremental input with TTL level
- Complementary inputs with error detection
- Counting range 24 bit
- Signaling of changes of the input levels
- Signaling of range overflows
- Galvanic separation between bus and process ground

Assignment of the Terminal Blocks

Terminal Block 1 (inner block)

Clamp	Name	Function
1	Ph_A	Phase A
2	Ph_B	Phase B
3	Ph_C	Phase C
4	nPh_C	Phase C inverted
5	nPh_B	Phase B inverted
6	nPh_A	Phase A inverted
7	—	Reserved, do not use
8	—	Reserved, do not use
9	ExtPWROut	Power supply +5V for external logic (output)
10	AGnd	Process ground
11	V+	Power supply +24V (input)

All voltages on terminal block 1 are related to AGnd.

Terminal Block 2 (outer block) N/A.

Operation Indication

The meaning of the different indicators is shown within the following table. The position of the indicators refers to the clamp mounted at the same height as the indicator.

Position	Colour	Function
10	red	Internal power supply connected
11	red	Power supply for external logic connected

CAN Communication

The module is accessed by 2 write, 4 read and 1 event variable. The message id's for the variable access are assigned during the configuration (see CST product line configuration manual).

LMT Address

The module has the LMT product name **CST1015**

Index of the Variables

Variable	No.	Length	Access	Description
Control	0	5 byte	Write	Write to the control registers
Status	0	4 byte	Read/Event	Read the status
Command	1	4 byte	Write	Execute a command
Pos_Val	2	3 byte	Read/Event	Read position

Registers of the Control Section

In addition to the bus specific flags (see CST product line configuration manual) the control section of the module also contains module specific flags in subregister 2. The bits are shown in the following table.

Name	Bit-No.	Description
Clear	0	Reset the counter

The module specific part of the statusregister contains the signals shown in the following table:

Name	Bit-No.	Description
InLim	0	Channel within allowed range
LoLim	2	Channel has fallen below the lower limit
HiLim	3	Channel has exceeded the upper limit
Error A	8	Error signal phase A
Ph_A	9	Phase signal A
Ph_B	10	Phase signal B
Ph_C	11	Phase signal C
Error B	12	Error signal phase B
nPh_B	13	Phase signal A inverted
nPh_B	14	Phase signal B inverted
nPh_C	15	Phase signal C inverted

Commands and their corresponding parameters are written to the command register and executed after writing. For this purpose a command is written to data byte 0 and the parameters are written to the following data bytes. The following table contains the possible commands and parameters.

CMD	Description	Parameter
0	Set lower limit	UNSIGNED24 LoLim
1	Set upper limit	UNSIGNED24 HiLim
4	Reset both error signals	

Note: The position data is internally handled as an unsigned 24 bit value. Any underflow or overflow results in an erroneous evaluation of the limits. It is therefore recommended to set the zero point outside of the area of operation.

Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Threshold of the input stage	0,8	—	2,4	V

Furthermore the nominal values specified within the chapter 'General Features' have to be considered.

Limiting Values

Parameter	Min.	Max.	Unit
Input voltage	0	5	V

Furthermore the limiting values specified within the chapter 'General Features' have to be considered.

